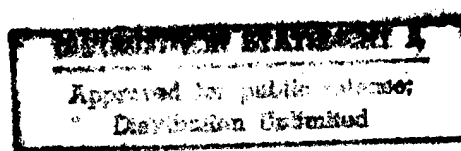


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18 October 1982



# USSR Report

MILITARY AFFAIRS

No. 1714

AVIATSIYA I KOSMONAVTIKA

No. 8, August 1982

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18 October 1982

USSR REPORT  
MILITARY AFFAIRS

No. 1714

## AVIATSIYA I KOSMONAVTIKA

No. 8, AUGUST 1982

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Outside front--Hero of the Soviet Union USSR distinguished military pilot, Major General of Aviation G. Bayevskiy meeting young officers. Photo by A. Kurbatov.

Inside front--Fulfilling the decisions of the 19th Komsomol Congress. Photo by A. Kurbatov.

Inside back--From the history of Soviet aviation. Photograph from the archives of the Central Palace of Aviation and Cosmonautics imeni M. V. Frunze.

Outside back--Celebrating a victory. Photo essay by A. Kurbatov.

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## AIR FORCES

CINC USSR AIR FORCE, CHIEF MAR AVN P. KUTAKHOV AIR FORCE DAY ARTICLE

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 82 (signed to press 2 Jul 82) pp 1-3

[Article by Chief Mar Avn P. Kutakhov, air force commander in chief, USSR deputy minister of defense, hero of the Soviet Union: "Inspired by the Party"]

[Text] This year our great socialist motherland is celebrating USSR Air Force Day in an atmosphere of great political activity and labor of the Soviet people and their soldiers, who are closely united about the Communist Party, its Leninist Central Committee and the CPSU Central Committee Politburo headed by an outstanding party and state official of modern times, CPSU Central Committee general secretary, chairman of the Presidium of the USSR Supreme Soviet, Comrade Leonid Il'ich Brezhnev.

Touched by the spirit of communist construction, the laborers of the cities and towns are selflessly implementing the historic designs of the 26th CPSU Congress and the plans of the 11th Five-Year Plan. All of these hopes and works of the Soviet people are channeled these days into an honorable welcome for the 60th anniversary of the Union of Soviet Socialist Republics, and they are permeated by a desire to mark the glorious jubilee with noteworthy achievements in development of communism.

Decisions of the May (1982) CPSU Central Committee Plenum have become new clear testimony of unwavering pursuit of a course of further growth in the welfare of the Soviet people and assurance of peaceful conditions for their life.

Presenting its broad and multifaceted program of social development and of raising the welfare of the people, the 26th CPSU Congress placed priority on the task of improving the supply of foodstuffs to the country's population. On Comrade L. I. Brezhnev's initiative the USSR Food Program, covering the period to 1990, was drawn up in support of this task. This program is the most important part of the party's economic strategy for this decade.

A powerful economic potential has been created in our country and its defensive power has grown under the wise, tested leadership of the glorious Leninist party.

The valorous armed forces are a dependable guard over the creative labor of the Soviet people and the bulwark of universal peace. Standing in a single

formation with the armed defenders of the Soviet Union, the air force began its heroic history with the birth of the world's first socialist state in the unforgettable days of Great October.

Soviet military airmen are rightfully proud that the great leader of the laborers of all the world and a genius in the strategy of the proletarian revolution--Vladimir Il'ich Lenin--was present at the birth of the air force, and that during the years of Soviet government the country became a mighty air power under the guidance of the Leninist party.

During the Civil War the combat traditions of the air force came into being and grew stronger, and Soviet airmen developed the best qualities in the fire of combat--selfless devotion to the ideals of communism and their people, revolutionary alertness and iron discipline, unbending steadfastness and courage, great piloting proficiency, initiative and daring in combat. For the bravery and heroism they displayed in battles for the motherland, 219 Red military pilots and air observers were awarded the Order of the Red Banner, 16 earned this award twice, and five earned it three times.

Mobilizing the Soviet people for implementation of the grandiose plans for socialist transformation of the national economy, the Communist Party took all steps to strengthen the country's defense capabilities and to supply its armed forces with the equipment they needed. Development of the air force became a truly national effort.

The firm Leninist course of the country's industrialization and the labor heroism of the people at the construction sites of the first five-year plans made it possible to create a strong material-technical base for swift development of domestic aviation in unprecedented time. In the 1930s air force line units began receiving warplanes, aircraft engines, armament and equipment that was not only not inferior to similar models produced in the developed capitalist countries but also superior to them. At the same time the network of military aviation schools widened in the country. On instructions from the party Central Committee the ranks of the air force were filled mainly by communists and Komsomol members. Thousands of communists tempered in combat and labor and tens of thousands of young men and women came to aviation at that time by the party's choosing and with Komsomol passes. Many of them later on became famous pilots, navigators and creators of new aviation equipment, they glorified the motherland with outstanding flights and aviation records, and they created modern combat and passenger airplanes, engines and armament.

Soviet aviation confidently grew in strength. In the 1930s our air force became a menacing weapon of the Soviet state's defense, and in the face of the growing threat of world war it was one of the factors restraining the aggressive aspirations of the imperialists. The lovers of military adventures felt the full force of Soviet aviation's blows during the conflict on the Chinese Eastern Railroad and in battles at Khasan, the Khalkhin-Gol River and the Karelian Isthmus. Faithful to their international duty, Soviet pilots courageously fought in the skies of republican Spain and China.



The Great Patriotic War was a harsh task for the Soviet people and their armed forces. In it, the power of Soviet aviation, the courage and valor of our pilots, their selfless love for the motherland and their devotion to the Leninist party and the ideals of communism manifested themselves with special force.

Together with other arms of the armed forces and branches of troops, the Soviet Air Force made a worthy contribution to the historic victory over German fascism. The heroism of Soviet pilots in the skies of the Baltic republics, Belorussia, the Ukraine, Moldavia, the Arctic, Moscow, Leningrad, Kiev, Odessa, Sevastopol', Stalingrad and other cities of our country makes up one of the brilliant pages of the history of the Great Patriotic War.

As a result of savage aerial combat and engagements in the skies of Moscow, Stalingrad and Kuban' and at Kursk, in summer 1943 Soviet aviation conclusively won air superiority and held onto it firmly until the total defeat of Nazi Germany.

During the years of harsh tests the exceptional moral-combat qualities of Soviet pilots manifested themselves with special force. Without vacillating, the valorous eagles entered into combat with enemy forces many times superior to them and won, they boldly penetrated to their targets through the densest curtains of fire, and whenever the combat situation and military and patriotic duty required, they hurled their aircraft into the airborne enemy.

It was with the greatest persuasiveness that our pilots demonstrated the moral strength of socialist patriotism, their devotion to communist ideals and their close unity about the Leninist party.

During the war Soviet airmen flew more than 3 million combat sorties, participated in hundreds of thousands of aerial battles and annihilated 57,000 enemy airplanes in the air and at airfields--more than two-thirds of the aircraft losses on the Soviet-German front. In addition to pilots of the air force and air defense fighter aviation, pilots of naval aviation also made a great contribution to the victory over the enemy. They are credited with two-thirds of the enemy ships that were sunk and damaged.

The Communist Party and the Soviet government gave a deserving evaluation to the deeds of the aerial warriors. Over 200,000 airmen were awarded orders and medals. The Hero of the Soviet Union title was awarded to 2,420 of them, 65 earned this lofty title twice, and famous aces--presently Marshal of Aviation A. Pokryshkin and Colonel General of Aviation I. Kozhedub--received this distinction three times. Orders were awarded to 895 air formations and units, 708 received honorary titles, and 288 became Guards units.

The immortal hero of the Great Patriotic War was the whole friendly multinational family of peoples inhabiting our motherland. The CPSU Central Committee decree "On the 60th Anniversary of Formation of the Union of Soviet Socialist Republics" notes that in the harsh years of the Great Patriotic War the brotherly peoples rose up to the defense of the motherland shoulder to shoulder, they displayed mass heroism and an unbending will for victory, they defeated the fascist invaders, and they saved the peoples of the world from enslavement and annihilation.

The tested Leninist party, which cemented and raised all of our people for the holy war against the aggressor, and inspired them to mass labor and military heroism of proportions unprecedented in the history of mankind, and to total defeat of the enemy, was the organizer of the world-historic victory of the Soviet people and their armed forces over Hitler's fascism.

At the front, the word "communist" was a symbol of fearlessness, unbending will for victory, and the preparedness to perform a mission in behalf of the immortal ideals of communism, peace and the welfare of our people, with no thought to one's own life. The places of fallen communists were taken in combat formation by new members of the great party of Lenin.

Having healed its wounds, in the postwar years the Soviet Union strode far forward in all areas of socioeconomic and political life, and now it appears to all the world as a country of developed socialism confidently marching toward communism, as the bulwark of universal peace and the security of nations.

Presently involved in communist development, the Soviet Union is consistently following a course of peaceful coexistence among states with different social structures, and of detente. During celebrations in Tashkent and at the 17th Congress of the USSR Trade Unions and the 19th Komsomol Congress, Comrade L. I. Brezhnev proposed, in his Peace Program for the 1980s, fundamentally new suggestions concerned with the entire complex of issues associated with bridling the arms race, and suggestions aimed at preserving peace on earth.

However, the reactionary imperialist circles of the West, and mainly of the USA, which hope to brake the course of world history, have no wish to make peace with the realities of the modern world, and they still harbor the hopes of achieving military superiority over socialism and regaining the role of the decider of the fate of peoples. "The militant course and aggressive policy of the NATO bloc headed by the USA," noted Comrade L. I. Brezhnev in the 17th Congress of the USSR Trade Unions, "compel us to take steps to maintain the country's defense capabilities at the required level."

The Communist Party and Soviet government are constantly concerned for strengthening the armed forces. This concern is reflected in the growth of the fighting power of the air force, which has everything it needs for life, combat training and performance of its missions. The air units are receiving improved aviation equipment, increasingly more powerful armament and the latest flight control and support resources reflecting the latest achievements of the scientific-technical revolution: Our air force has now become a powerful arm of the USSR Armed Forces. It is highly mobile and maneuverable, making it possible to quickly shift the efforts of aviation from one sector and theater of war to another, to penetrate deep into the enemy rear, to use different weapons and electronic warfare resources in all weather conditions at any time of the day and year, and to make sudden strikes from the air against large permanent and small mobile targets. Today the main indicator of the power of the Soviet Air Force is its high combat readiness.

Striking changes in equipment and weapons have required the personnel to master modern devices and instruments as quickly as possible. In view of this, the air force pilot and navigator schools have been transformed into institutions

of higher education, and their graduates are now receiving diplomas of pilot-engineers and navigator-engineers.

The Sixth All-Army Conference of Primary Party Organization Secretaries, which was held in May of this year, has become an important stage in the life of army communists and yet another bright confirmation of the party's concern for the Soviet Armed Forces and for improving party-political work in the troops.

Military airmen are persistently implementing the decisions of this conference. Party-political work in air force units and subunits has become more substantial and concrete, satisfying the present conditions and the new missions. This work is aimed at nurturing air warriors fully devoted to the party, the motherland and the people and possessing high moral-political, combat and psychological qualities. The commanders, political workers and party and Komsomol organizations are basing this effort on the idea that communist ideology and conviction is the backbone of the soldier's character, something which has helped and continues to help all generations of soldiers to find the strength to surmount all difficulties of military service and to achieve their missions without fail.

The selfless faithfulness of air force personnel to the cause of the party and to heroic traditions, and their deep understanding of their duty to the people were manifested persuasively once again in exercise "Zapad-81" held in September of last year. This exercise became an examination of the combat proficiency of air units and subunits, and a test of their preparedness to perform any assignment of the motherland associated with defending the accomplishments of socialism and the peaceful labor of the Soviet people.

A socialist competition that has evolved in the troops for an honorable welcome to the 60th anniversary of the USSR's formation under the slogan "Dependable protection for the peaceful labor of the Soviet Union!" is an effective means of attaining high end results in training and service, maintaining high combat readiness and raising the effectiveness and quality of the aerial skills of military airmen.

As always, communists and Komsomol members are marching in the vanguard of the socialist competition. During the days of the 19th Komsomol Congress, the Komsomol of the armed forces proposed a new patriotic initiative: "Komsomol concern for modern combat aviation complexes!"

The leaders of the socialist competition in the air force--units and subunits commanded by officers V. Sadikov, V. Mokhov, V. Maley, A. Mikhaylov and others--have attained new summits in improving professional skills and raising combat readiness this training year.

The CPSU Central Committee and the Soviet government value the labor of military airmen highly. Each year hundreds of the best representatives of the air force earn state awards for outstanding indicators in combat and military training, while the cream of the crop are awarded the honorary titles "USSR Distinguished Military Pilot" and "USSR Distinguished Military Navigator." The military airmen are passing their days in hard military labor. The party's high trust in the defenders of the fatherland's skies and its untiring concern

for strengthening the fighting power of the air force and keeping it at a level ensuring effective completion of the most complex missions obligates us to many things.

We must ensure strict organization of the entire training and indoctrination process and its further intensification in precise compliance with the requirements of manuals, orders and instructions, we must persistently fight for effectiveness in lessons, exercises, flights and combat duty, we must maintain unweakening control over fulfillment of training plans and programs, and we must fight an uncompromising struggle against laxity and simplifications and against inefficient use of time allocated to combat and political training.

The main thing in ideological and political indoctrination is to deeply study and publicize the decisions and proceedings of the 26th CPSU Congress, Comrade L. I. Brezhnev's directives on defense issues and decisions of the November (1981) and May (1982) plenums of the CPSU Central Committee.

In flight training, as before, greater attention must be devoted to the air training of the personnel and to improving the tactical, fire, technical and special skills and the moral, political, psychological and physical maturity of the soldiers. We must do everything we can to improve the combat coordination of subunits and units, and display constant concern for flight safety.

We must achieve a situation in which every air commander and political worker who is responsible for organizing the training and indoctrination of the personnel understands the new moral, physical and psychological trials our soldier will encounter in real combat, if the imperialists ever begin a war, and the reserve of strength--combat, ideological and moral--required of the motherland's defenders even in peacetime.

The Soviet people dearly love their winged defenders of the motherland, and they are proud of them. Airmen have added many glorious pages to the heroic history of our great country and its armed forces. Their noteworthy military deeds will always serve as an example, to the present and subsequent generations of air warriors, of faithfulness to the cause of the Communist Party and military duty, courage and nobility.

Glorious Soviet pilots have always been in the ranks of the pioneers of the unexplored, and they have always committed acts of heroism boldly, multiplying the glory of their fatherland. Unlimited love for their profession, boldness, decisiveness, a thirst for knowing the new, a strict and demanding attitude toward each of their steps in life and service, high awareness, a sense of responsibility, discipline and diligence are inherent to them. All of these qualities, taken together, make up the foundation of the moral-political countenance of our airmen--true Soviet patriots and internationalists.

Soviet airmen are marking USSR Air Force Day with new successes in combat and political training and in the socialist competition for an honorable welcome to the 60th anniversary of the USSR. Faithful to their constitutional duty, as with all soldiers of the armed forces they are improving their military proficiency daily and purposefully, they are raising their alertness in every

possible way, and they are strengthening the combat readiness of the air force, protecting the peaceful labor of Soviet people and dependably defending the state interests of our fatherland--the Union of Soviet Socialist Republics.

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## AIR FORCES

### HELICOPTERS: 'ZAPAD-81' TACTICAL TRAINING DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 82 (signed to press 2 Jul 81) pp 4-5

[Article by Maj Gen Avn D. Folomeyev, military pilot 1st class: "Predicting the Combat Situation"]

[Text] It is difficult to overstate the role of tactical flying exercises in improving the combat skills of airmen. New tactics are worked out and the fire proficiency of the air warriors is honed in tactical flying exercises. Combined-arms exercises, in which aviation is closely coordinated with the ground troops, have especially important significance. Airmen gained many useful things in exercise "Zapad-81." The experience of this exercise is still being carefully studied today in our units and subunits.

Army aviation demonstrated a high level of combat training in the exercise. Not only individual crews but also different tactical groups successfully completed their missions, operating in extremely complex conditions. This became possible mainly owing to the bold and competent actions of commanders and chiefs, to the high aerial and technical skills of the lead groups and of all pilots, to their ability to coordinate well with gunners, motorized riflemen and tankmen and to their moral, political and psychological strength.

The experience of exercise "Zapad-81" also confirmed that in the hands of a well trained crew, the helicopter is an effective weapon against enemy armored and artillery objectives on the battlefield. And the more thought there is behind the commander's decision for using helicopters and the more initiative and persistence is displayed by lead groups in attaining the goal, the more effective are their actions.

The exercise showed how important it is for high quality fulfillment of flight assignments by crews and subunits to clearly describe the situations in which they will be operating and define the missions and the sequence of their completion in place and in time.

Utilizing this experience, prior to the next exercise in interaction with ground subunits, the senior air chief turned the attention of Officer M. Shakirov to the fact that the featureless, marshy forests along the flight route and the hilly, extremely rough terrain in the vicinity of the strike would make target search and detection significantly harder. But this was

not to influence the precision of arriving at the objective in place and in time. He explained that all artillery will be "working" against the same targets, that its density of fire will be great and that the trajectory of the shells would intersect that of the helicopters, given the altitude at which they were supposed to fly. Therefore if the helicopters appeared in the region of operations just a few seconds earlier, they could be struck by their own artillery.

Moreover the commanders were made aware of the fact that another artillery strike would be possible immediately after the air strike. Their attention was also turned to the fact that following the action of our artillery, the fire of "enemy" antiaircraft resources could be somewhat weakened, but that the target would be obscured by smoke and raised dust. Then distinguished USSR military navigator, Officer M. Sakharov informed the airmen of the time standards which would ensure precision in the initiation and termination of the strikes.

As we know, one of the most important ways of attaining success and exploiting it is to competently organize aggressive, anticipatory actions by the troops, and constantly hold onto the initiative in the course of combat. The time factor acquires decisive significance here. Where are we to find extra time? First of all we can reduce the time it takes to make decisions, to draw up the necessary documents and to communicate the missions to each airman. This can be done through clear distribution of responsibilities among officials, thoughtful organization of the activities of the staffs and broad utilization of electronic resources for operational and tactical calculations.

Prior to the exercise, Officer M. Shakirov received his assignment and drew up his plan. First of all he had to get together with officers of the higher staff to coordinate on interaction with the commanders of the ground subunits in behalf of which the helicopters were to operate, and to bring the final flight plans to the awareness of the flight crews. He gave this important and complex job to Officer N. Lysov, who was aided in his effort by Yu. Krupin, a liaison officer from higher staff.

Final coordination was reached on the signals to be used in designating the forward edge of friendly troops and in calling for an artillery ceasefire when helicopters would fly into their zone of fire, and a number of other issues. To control helicopters over the battlefield, the helicopter subunits provided forward air controllers who, being in the combat formations of the tankmen and motorized riflemen, could accurately estimate the situation. The helicopter crews were guided to their targets and opened fire in response to their commands.

Following the conference, the commander of the air unit made the decision to send groups of helicopters headed by officers V. Vnukov and Ye. Goryunov against area targets at the "enemy's" forward edge of defense, and groups led by officers B. Yeliseyev, V. Shapovalov and others against small armored targets. Officer M. Shakirov explained the mission to the lead groups in the presence of all the flight personnel. Because time was extremely short, to explain the mission better the commander used a representation of the mission on a map, a plotting board showing the target area and serving as a good visual

aid, and reference materials. The actions of the crews in different weather and tactical conditions were analyzed in detail.

In order to make preparation of the crews more objective, as in exercise "Zapad-81" mock-ups representing the region of combat activities, showing the targets subject to annihilation, were set up at the airfields. On receiving their assignment, under the guidance of their leader the pilots used the mock-ups to work out different variants of the maneuvers to be used in making the strikes. They devoted special attention to withdrawing the helicopters from the zone of antiaircraft fire.

During this time the engineers and technicians carefully inspected and prepared the craft for flight on the parking pad. Once again they checked the engines, the propulsion units and the armament systems, upon the work of which successful use of all weapons in a single pass depended. Experience showed that this requires not only the dexterous work of the helicopter commander with the weapon controls but also the faultless technical condition of ammunition and the entire weapon system.

Remembering the commander's instructions to prepare the helicopters for a turnaround sortie at a temporary airstrip in limited time, Officer N. Frolov turned special attention to the location of the specialists, to their coordination, to prompt delivery of ammunition and to its convenient distribution. The most suitable refueling variants were sought out and selected as well.

The commander approved the variant proposed by the engineer. Following several training sessions, confidence grew that the helicopters would be prepared successfully for the turnaround sortie in unusual conditions. Later on, the exercise persuasively demonstrated that given clear leadership, well-conceived work organization and the high professional skill and purposefulness of the specialists, the existing standards for preparing the aviation equipment could be surpassed.

An umpire who visited the helicopter pilots became convinced that despite the field situation the flight crews had prepared themselves fully.

The exercise began. The mission was to destroy ground targets with rocket missiles. The commander ordered Major Ye. Goryunov's group to strike area targets as a supplement to the artillery strikes by the ground troops, and he ordered Major V. Shapovalov's group to strike point targets. As the crews prepared for take-off, the commander advised the lead group to thoroughly study the region of "combat" and recalled the actions they should take in unusual situations. He believed the probability of poor visibility to be the main factor to be considered in the evolving situation. He turned out to be right.

Clear weather is not all that usual in our locale. A thick fog enshrouded the forests and fields from early morning. Visibility was zero. But soon the fog began to lift. The long-awaited command sounded: "To your helicopters!"

But from the way things looked, nature made it its goal to prevent successful completion of the mission, concealing the target area with fog and thick smoke.



The "enemy" was joined by an "ally" who had to be overcome by will and skill. In order to reach the target covertly, the helicopters traveled at minimum altitude.

In such flight it is very difficult to maintain visual orientation due to the great angular velocity at which landmarks pass by. Only flickering tree crowns, which merged together beneath the helicopter into a continuous grayish-brown mass, could be seen through the glazing of the cockpit. Suddenly a landmark would spring out: a lake, a stream, a forest road. It would spring out and then immediately disappear. This was the time for staying on one's toes! The helicopter pilots had to hold precisely to their assigned altitude, speed and course, watch for obstacles and monitor the work of the instruments and systems. And all of this had to be done integrally. The ability to simultaneously read a piloting chart and compare it with landmarks in minimum time is itself an art. It is very important to determine the location of the helicopter. And not simply determine, but find it with such precision that reaching the target area at exactly the right place and time would be absolutely guaranteed.

The crew of the lead helicopter, which was under the command of Military Pilot 1st Class Major Ye. Goryunov followed its route precisely, as plotted on the map by navigator Captain I. Polyanskiy. The subordinates followed their leader. Among them was the crew of the squadron deputy commander for political affairs, Captain A. Savochkin, who confirmed by personal example that a communist has but one privilege--that of being where things are hardest.

As we know, group flight requires the pilot to be highly proficient and responsible. Drill always disciplines soldiers. And it is on discipline that the success of an assignment depends in many ways. The flight of a group in which the followers faultlessly maintain their assigned intervals and spacing, and clearly react to all maneuvers of the leader, cannot but elicit pride and delight. This is achieved through persistent training and through indoctrination of a high sense of responsibility for one's aerial skills.

It was the last maneuver prior to assuming that attack course. The group leader, Major Ye. Goryunov, observed puffs of smoke and dust simulating the explosions of antiaircraft shells, which stood as a solid wall in the way of the helicopters. It was precisely here that the regiment commander's foresight in bringing up the probability of having to attack targets in poor visibility manifested itself. But utilizing the experience he accumulated in exercise "Zapad-81," Major Goryunov boldly led the group to the target. He climbed over the upper edge of an obstacle. His followers kept right up with him. It was here that the skills acquired during work on the combat training program came in handy. The pilots had learned to fire against area objectives that could not be seen, utilizing lateral reference points at the target line and the limit of opening fire. The crew leader adjusted his actions to the situation perfectly and reached the zone of fire.

"Attack!" could be heard on the radio, followed by: "Fire!"

Rocket missiles flew toward the target.

"Turn right!" commanded the leader, and the group withdrew from attack, descending as it turned. The helicopters assumed their return course. The helicopter strike was successful. The "enemy" suffered serious losses.

Modern combat requires the pilot, and mainly the leader, to have outstanding aerial skills, high discipline, initiative and resourcefulness. A confirmation of this can be found in the actions of the crews contained in the group headed by Military Pilot 1st Class Ye. Goryunov.

In real combat, it is the enemy who always "grades" the level of aerial skills. The "grade" is strict and uncompromising. Frequently the situation depends on two factors--killing or being killed. But in exercises, even in the most important, victory and defeat are not for real. Taking advantage of this situation, some commanders apparently condone laxity in the training of their subordinates and simplifications in their preparations for flying. We can categorically assert that he who does not reckon with the requirements of modern combat and does not develop discipline, initiative and resourcefulness within himself will never achieve success.

For example during one tactical flying exercise a group of helicopters headed by Captain V. Bliznetsov was given the mission of striking an "enemy" strong-point in the zone of advance of a rifle platoon. The commander worked out the maneuver to be used in attaining the target stereotypically, without considering the evolving situation in the region of the attack. The group entered a cloud of dust offering extremely limited visibility and making it impossible to detect and annihilate the target in time. To avoid collision with the ground, the leader was forced to escape to airspace offering better visibility. The crew did not complete its assignment.

The incompetent actions of V. Bliznetsov, and of his follower G. Dement'yev, who lost his leader, were analyzed in the subunit and brought to the awareness of all army aviation flight crews, which made it possible to subsequently preclude similar cases, even when the situation was complex in the air and on the ground.

Every tactical flying exercise is a test of the work done by commanders, political workers, staffs and all personnel. And the greater the intensity of the exercise, the more active and aggressive should be the party-political work, the more concrete and efficient it should be in support of the missions. This is confirmed by the proceedings of the Sixth All-Army Conference of Primary Party Organization Secretaries. The experience of such exercises and of all combat and political training indisputably persuades us that highly effective party-political work has decisive influence upon improving the proficiency of airmen. Sparing no effort, military airmen participating in the socialist competition under the slogan "Dependable protection for the peaceful labor of the Soviet people!" are studying and introducing the experience of the exercises, they are achieving new successes in military labor, and they are honorably justifying the high evaluation given to the USSR Armed Forces by the 26th CPSU Congress.

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## AIR FORCES

FLIGHT TRAINING: CINC MOSCOW MILITARY DISTRICT AIR FORCE COL GEN AVN  
V. ANDREYEV ON AERIAL COMBAT

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 82 (signed to press  
2 Jul 82) pp 8-9

[Article by Col Gen Avn V. Andreyev, air force commander in chief, Order of  
Lenin Moscow Military District, USSR distinguished military pilot: "Flying  
and Combat"]

[Text] Aerial combat can be defined as an armed aerial duel between single  
airplanes or groups, combining fire and maneuver with the purpose of annihilat-  
ing the opponent or warding off his attacks. In fighter aviation this is  
the principal method of fighting for air supremacy, as was persuasively  
demonstrated by the experience of the Great Patriotic War: Out of the total  
number of airplanes lost by fascists at the Soviet-German front, 57,000 were  
annihilated by our pilots in aerial combat and at airfields. Piloting tech-  
nique--maneuvering in the horizontal, vertical and oblique planes for the  
purposes of making indefensible attacks--played an important role in this.

Our country is the birthplace of flying. "The military pilot," said the  
founder of flying, P. N. Nesterov, "cannot do without the ability to perform  
aerial maneuvers.... Vertical banking and sliding turns, half-rolls and loops  
must be part of the mandatory program...."

Soviet airmen persistently assimilated and improved piloting techniques.  
Growth in their proficiency was based on detailed study of the tactical and  
technical characteristics of the airplanes they used, and on deep knowledge of  
aerodynamics and tactics. The ability of fighter pilots to use diverse com-  
plexes of aerial maneuvers with a jeweler's precision and to fire accurately  
no matter what the airplane's attitude was one of the decisive prerequisites of  
the victories in aerial combat with the Nazi invaders. Major General of  
Aviation Aleksey Vasil'yevich Alelyukhin, a twice-awarded hero of the Soviet  
Union and a famous Soviet ace, is still serving in the air forces of our dis-  
trict. He was credited with knocking down 57 fascist airplanes. A distinguish-  
ing trait of Alelyukhin's fighting style was the precision of his piloting,  
his ability to fire accurately no matter what the attitude of the airplane.

The experience of aerial combat in the Great Patriotic War is extremely rich  
and diverse. Fundamental changes occurred during the postwar years in the

resources of armed conflict and in the theory of the art of war, but many components of this experience did not lose their practical significance. And in general, they continued to serve as the inexhaustible sort of moral-political, psychological and combat training for the present generation of Soviet airmen, and as a firm foundation for further development and improvement of the forms and methods of combat application of aviation, with a consideration for modern requirements.

Several years ago during an exercise I acted as the leader of a group of fighters in fluid aerial combat. The "enemy" had almost a twofold superiority in numbers of airplanes, and he had the advantage in altitude. But the piloting and tactical training of the pilots in our group was better. We maneuvered more competently, and we made fuller use of the tactical and technical potentials of the airplanes and armament. This produced success.

But success had its origins on the ground: Prior to the flight we once again recalled how frontline heroes had acted in a similar situation. Their experience came in handy in determining the combat formation and in performing maneuvers that would distract the attention of the opposing side and place the strike group in a tactically advantageous position for attack.

This combat taught a great deal to both the victors and the vanquished. It confirmed once again that piloting and tactical proficiency have always been the principal weapon of the pilot.

Now that airmen are performing combat training missions in all kinds of weather and at all times of the day, and now that airplanes are outfitted with fundamentally new armament, aerial combat imposes new, higher requirements upon the pilot. The significance of tactical skills and piloting techniques has now grown by several orders of magnitude.

An exercise was going on. Guards Major A. Guзов, the squadron commander, received an important mission--annihilating the aerial "enemy" in an area covered by a tight ring of antiaircraft resources. The squadron's pilots crossed the "front" line at low altitude and maximum speed. Performing tactics worked out beforehand, they surmounted the air defenses and reached the target area precisely. Using vertical maneuvers the flights made their attacks from different bearings. Communist top-class pilots Guards Major V. Kukhar', Guards captains Yu. Ivanshchenko and V. Gribanov and others struck their airborne targets with the first rocket. Subordinates of Officer Guзов also showed their better side in fluid aerial combat that followed.

Behind the seconds which predetermined the success of the combat were long hours of theoretical training, regular flying, meticulous and comprehensive analysis of the flying, study of the experience of the Great Patriotic War and of tactical flying exercises, and its creative application. A great deal of work was invested into the victory by the commanders and officers of the command post and staff. Success was attained because all fulfilled the commander's instructions in the air without exception, because they all kept their places precisely in the combat formation, because they made complex maneuvers when surmounting air defenses and in the target vicinity in accordance with a single plan, and because they unfailingly complied with the rules of radio discipline.

The following detail is typical. The pilots of the subunit were operating at low altitude. The limited possibilities for maneuver due to the complex weather conditions and the closeness of the ground introduced additional difficulties. And because the main attention was turned to the principal mission--hunting for and detecting targets, less attention was devoted to piloting itself. This example once again confirms that under otherwise equal conditions, a pilot having extremely firm, well developed habits of aircraft control will complete his mission more successfully.

Training in complex piloting and combat maneuver in a single airplane and especially as part of a group is an extremely important phase of flight training. The squadron headed by Guards Major Guзов made diagrams of various maneuvers and their combinations. All actions of the air warrior are validated by the appropriate calculations, and the order of distributing and switching attention in different situations and the typical mistakes are shown. Every pilot of the subunit is acquainted with these models, and in aerial combat he makes creative use of them, depending on the situation.

The plan the squadron has drawn up for improving piloting techniques foresees the conduct of exercises until such time that the pilots begin to get a real feel for the airplane. Each sortie is preceded by comprehensive preparation under the guidance of the instructors, careful testing and, invariably following the latter, analysis using flight recorder data. If a group is to take off for combat maneuvers, the latter are played out on the ground, and the tactics and possible actions of the pilots are worked out in detail.

Guards Major Guзов and the executive staff of the squadron are careful to see that the monthly norms for piloting technique, coordinated group flying and combat maneuvers are mandatorily fulfilled. This is fundamentally important: Modern training apparatus makes it possible to preserve and even improve proficiency in some forms of flight training, but piloting habits can only be acquired and developed in the sky. It is precisely out there that the knack of visual estimation is developed, that the pilot begins to keenly perceive the slightest changes in the distance to an airplane flying in front of him, and that he acquires swiftness in his reactions and the ability of efficiently and correctly respond to an evolving situation.

The commander of this progressive subunit is strict and objective when he evaluates achievements, and he is exacting toward himself and his subordinates. He systematically recalls to the pilots that success is guaranteed only by the highest possible diligence, and that any deviation from the rules of flight service established by the documents and dictated by experience, no matter how negligible it might seem, would inevitably complicate the situation. And this could cause the failure of the combat training mission and create the preconditions for a flying accident. Generalization and introduction of the best experience has become an important resource in the squadron for raising the quality of pilot training given to the air warriors, group coordination and combat maneuver. In particular, before the exercises described above, the pilots listened with great interest to talks given by communists Guards captains V. Griбанov and Yu. Ivanshchenko, which played a positive role.

There is one more thing I would like to talk about. The commander, political worker and activist of the subunit organized the training, indoctrination and party-political work in such a way that pilots practicing solo and group piloting techniques would view each maneuver as a combat maneuver, one which could be used in a concrete aerial situation to attack the enemy and to achieve victory over him. They recalled that each pilot must always be ready to complete his mission in outstanding fashion day and night, in the most complex tactical and meteorological situation. In other words aggressiveness and the desire to wage aerial combat offensively, to impose their will upon the opposing side and to achieve victory is regularly instilled in the officers.

The purposeful activity of the command and the party organization is making the squadron a unified collective. Communist Guards Major Guзов is always certain that the pilots are at their places in the combat formation and that they are accurately maintaining their speed, altitude, acceleration and banking. They are forged together by a unity of plan, goal and actions, and the internal ties of this monolithic unity are so strong that nothing can tear them apart.

We have many crews and subunits whose actions in combat training sorties satisfy wartime principles--decisiveness, boldness and full exertion of strength. The pilot training experience of the heroes of the past war has been made available to all air units. It is used in flight training with a consideration for the greater complexity of equipment and the broader range of speeds and altitudes, and it is enriched with new elements corresponding to the requirements of modern combat.

But unfortunately we also encounter cases of understating the significance of complex piloting techniques and aerobatics, group coordination and combat maneuver. Certain pilots with high class qualifications who fly on instruments fabulously and are capable of successfully intercepting targets in the clouds sometimes find themselves weakly prepared for a duel with the enemy in fluid combat. Such pilots have developed a simplified idea of aerial combat: Taking off after a target in response to a command from the ground, flying with afterburners on, attacking swiftly, and taking a few seconds to sight and launch missiles. From this they mistakenly conclude that piloting techniques are now something of the past.

We must of course give credit to instrument piloting, to the possibility provided by instruments for knocking down an airborne target at great range and at different angles. The importance of instruments cannot be disputed when the enemy is attacked by a modern missile-carrying fighter and when sighting is performed by means of the most sophisticated instrument complexes. But even under these conditions the pilot must often perform swift and bold maneuvers. It is at such times that he simply cannot do without highly artful piloting skills. Moreover modern aerial combat does not preclude a situation in which a fighter would have to attack an enemy with visual contact, using missiles and cannons. Without outstanding training in piloting techniques, it would be impossible to learn to engage in free, fluid aerial combat.

In one of our subunits, in which insufficient attention was devoted to training in piloting techniques, the pilots performed much worse in the exercise. They

could not maintain their combat formations, they made significant mistakes in their target approach, and they did not utilize the potentials of their airplanes fully. Stereotypy dominated their work: All groups used the same maneuver against antiaircraft resources while en route.

We could hardly blame the pilots of the squadron for their failure. They did exactly what the commander told them to do, and they acted just as they were taught. But they were taught incorrectly. The senior chief had to intervene and take steps to correct the errors.

Mistakes in pilot training can also produce other unpleasant consequences: The error of one pilot may cause a threat to the entire group. Memorable in this connection is an incident that happened with Officer V. Alifanov, who did not maintain his place in a group during a combat maneuver. An extremely complex emergency situation arose.

These are not regular occurrences. But we cannot ignore them. Those commanders who try to make the conditions as close to those of real combat as possible and teach their pilots to quickly use that tactical maneuver which would ensure success in concrete conditions not only in tactical flying exercises but also when organizing routine flying are doing absolutely the right thing. For pilots to perform in this way, they must have a perfect knowledge of their airplane and its aerodynamics. Maximum utilization of the potentials of the equipment and armament and creative application of the experience of the Great Patriotic War and of the latest achievements of military science are the levers by which we can and must improve the combat proficiency of pilots and raise the flight safety.

We maintain a principled attitude toward piloting techniques in our units and subunits basically because in a duel between two airplanes having equal tactical and technical characteristics, victory would belong to the pilot who has better mastery over the equipment, and who is faster in performing a conceived maneuver and opening accurate fire. Highly skillful piloting is also required of pilots in fighter-bomber aviation. If they are to competently strike targets while making complex maneuvers, they must be true virtuosos of the skies; they must perform combat half-rolls, loops, Immelman turns and other complex maneuvers in direct proximity to the ground. Moreover fighter-bombers will have to not only annihilate the enemy on the ground but also provide cover to friendly troops, repelling raids by enemy airplanes.

Defensive maneuver (antifighter maneuver) combined with fire and jamming is the basis of aerial combat between a bomber, reconnaissance airplane or helicopter crew and a fighter. Here as well, highly skillful piloting will become one of the principal and decisive components of success. Thus a high class of airplanes and helicopter piloting is not an end unto itself, but the road to victory.

This is the rule followed in our units and subunits. Intense summer combat training is now going on everywhere. Implementing the requirements of the 26th CPSU Congress, the pilots of our military district are honorably fulfilling

their mission of protecting the creative labor of the Soviet people and dependably defending our country's state interests, and they are preparing for an honorable welcome to the 60th anniversary of the USSR.

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## AIR FORCES

### FIGHTERS: CLOSE CONTACT WITH GROUND CONTROLLER NECESSARY

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 82 (signed to press 2 Jul 82) pp 10-11

[Article by Capt Ye. Shpits: "In Close Contact"]

[Text] Modern fighters are outfitted with effective radar sights permitting the pilot to independently search for, detect and strike a target even without visual contact. Nevertheless without the help of the command post, complete success in annihilating an airborne enemy would be far from a simple thing. The problem is that given the enormous spatial scope of combat, it is difficult for the pilot to analyze the aerial and tactical situation, to correctly evaluate it, and to select the variant of the attack on his own. He is aided in this by the tactical control officer, who possesses more powerful detection and monitoring resources, owing to which he can quickly and accurately analyze the evolving situation and the strength of the sides, and thus have a decisive influence upon the outcome of the battle. Naturally, efficient and business-like contact must be organized between the pilot and the tactical control officer.

Experience shows that the professional skills of each of these officers, no matter how high they might be, are no longer enough. The time allotted to a mission is constantly decreasing as aviation equipment and weapons undergo improvement. This is natural. And this is why we must now face the problem of developing the closest possible interaction between crews and the officers of the command post. They must work as a single whole, as a powerful fist aimed at the enemy's vulnerable point.

If he is to complete this task in the most effective way possible, the tactical control officer must have as good a knowledge of modern air tactics, the possibilities of his equipment and that of the enemy and of many other issues within the competency of the command post as do the flight crews. He must also possess personal qualities and capabilities equal to the pilot he is controlling.

We conducted an experiment in our unit in which command post officers and the flight crews of an outstanding squadron took part. This squadron was headed by an experienced commander and a top-class pilot, Major V. Rychagov. Tactical control officers Lieutenant V. Spevakov and practical training instructor Specialist 1st Class Senior Lieutenant V. Byakov were assigned to the subunit. They

attended all lessons conducted with the squadron's pilots over a long period of time. For example while working together with them in the gymnasium they studied the physical possibilities of the air warriors, the swiftness of their reactions and their motor activity. During lessons in tactics, hardware and aerodynamics they observed how the pilots accumulated new knowledge, and during preflight preparations they studied the assignment and the order of the exercises together with them, thus gaining a deeper knowledge of the people. During the preflight briefing the squadron commander offered problems to both the pilots and the tactical control officers. Thus all of the participants benefited identically from such measures. The result of the joint lessons was not long in making itself known.

For example the number of times pilots were guided to their targets with just a satisfactory score decreased by 85 percent. While during initial training Lieutenant Spevakov guided his attacking crews into the rear hemisphere at ranges exceeding the permissible standards, and instructor Senior Lieutenant Byakov had to intervene in control, a certain time after joint training with the flight crews was started, such cases became a rarity. The lieutenant became confident of his strengths and possibilities, and of the experience of comrades controlling the powerful equipment.

The theoretical training level of the tactical control officers rose significantly in relation to technical disciplines, tactics, aerodynamics and navigation. Much work was done during the experiment by the squadron's deputy commander, Military Pilot 1st Class Major V. Zozul'. Analyzing a particular exercise, he mandatorily related each phase of a flight with the potentials of the monitoring and control resources available in the given case to the command post officer. As a result the pilot in the air was under constant and watchful observation, which significantly increased the reliability of control and safety in performance of the assignment.

The flight crews became more confident that the tactical control officer would efficiently provide the assistance they needed even in an emergency situation. The number of times radioed commands had to be clarified was halved. Radio communication was carefully studied on the ground, the speakers practiced making their commands brief and accurate, and the pilots and tactical control officers began to understand one another intuitively.

Major V. Dunayev provided truly invaluable assistance to the experiment. Having enormous experience in control, and possessing sound theoretical knowledge in many specialized disciplines, he provided timely hints as to when problems might arise and as to what would have to be done to ensure continuous, efficient and dependable control over the crews and groups of airplanes in the air and to organize close interaction between them. The meticulous work resulted in an undeniable conclusion: The more closely pilots cooperate with tactical control officers, the greater is the probability that they would complete their combat assignments. It should be noted that even before the experiment, this had often been the topic of discussion, and everyone felt subconsciously that there were concealed reserves in this area.

The tactical control officers now assigned to our subunits always possess dependable information on the training of the flight crews. This makes it possible to efficiently complete the missions assigned in routine flying and in tactical flying exercises.

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## AIR FORCES

### SUPPORT SERVICES: DEVELOPMENT OF AIR FORCE REAR SERVICES AND SUPPLY DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 82 (signed to press 2 Jul 82) pp 18-19

[Article by Col Gen Avn V. Loginov: "New Goals of Air Force Rear Services"]

[Text] The personnel of the air forces rear services are working hard with great enthusiasm in the summer training period. Having joined the socialist competition for an honorable welcome to the 60th anniversary of the USSR, the soldiers are aspiring to achieve new goals in improving their professional skills. Specialists of the air force rear services have been assigned complex missions--preparing and operating airfields, supporting the flying, supplying materiel and technical resources to the air units and organizing personal services and medical treatment for the personnel.

The rear services are also involved in the planning of cargo transport by motor vehicle, water and rail over great distances, and they must satisfy the house-keeping needs of the air garrisons. Rear service specialists perform repairs and overhauls on complex permanent and mobile equipment, they are responsible for the storage of various aircraft weapons, and they assist in the construction of airfields and various maintenance facilities.

As we know, simultaneously with swift development of the air force and improvement of aircraft, the rear subunits have also undergone reequipment. Personnel training methods have improved, and the tasks of rear support to aviation have grown more complex. Various machines, devices and mechanisms are now used to prepare airplanes for take-off: units to start engines, test the electronic, electrical and hydraulic systems of aircraft and fill their systems with compressed and liquefied gases; resources used to fill aircraft with fuel, oils, lubricants and special liquids, and POL transportation resources; aircraft towing tractors, and motor transportation used to carry personnel, various cargo and ground equipment. Finally there is equipment used to obtain various gases: vehicle-mounted and railroad oxygen and nitrogen production units and trains, general-purpose compressors producing dried high-pressure compressed air, units used to test cockpit airtightness, multipurpose air conditioners, mobile air heaters and so on. Equipment associated with summer and winter maintenance of airfields also occupies an important place. This group of mechanisms is represented mainly by rotary snowblowers, thermal generators and combined irrigating-washing and vacuum cleaning machines. Our airfields are now being equipped with complex navigation and piloting systems and braking devices operated by complex electronic systems. It stands to reason that what

is important is not the quantity of machines and equipment employed but their sophistication and effectiveness.

But no matter how sophisticated the flight support and maintenance resources might be, people having a perfect knowledge of the equipment entrusted to them are at the foundation of the fighting power of the air force rear services. Supporting flying in occasionally very complex aerial and meteorological situations, they learn courage, faithfulness to military duty and military proficiency from veterans of the civil and Great Patriotic wars and from the senior generation of air force rear services specialists.

Organizational measures aimed at reinforcing air force rear subunits were implemented on the basis of the experience of the combat activities of aviation in the Civil War and in accordance with a decision of the 10th VKP(b) [All-Union Communist Party (of Bolsheviks)] Congress. They were separated from the air force detachments and placed in newly formed air squadrons. Later on, aviation workshops--brigades and separate squadrons--were formed to provide rear support to air formations and units. A workshop was located in an airfield complex, and it had the possibility for providing two or three detachments (commandant staffs) in support of air squadrons based at other airfields. Thus the formerly scattered subunits supporting the air squadrons were united into a single rear services organ (the aviation workshop). It was the prototype of the modern airfield technical unit.

However, despite the measures undertaken by the party Central Committee, the air force rear organization that had evolved by the beginning of 1941 did not satisfy the requirements of maneuverable warfare. This is why all of the territory of the western frontier districts was broken down into several aviation base areas (RABs) in compliance with a decree of the VKP(b) Central Committee and the USSR Council of People's Commissars dated 10 April 1941. Each of these areas was to become the principal rear services organ of the air forces of the army and district (front), and it was intended to support three or four air divisions. The composition of the RAB included bases--one per division, and the composition of each base included three or four air base maintenance battalions (BAOs).

The reorganization was to be completed by 1 August 1941. But the surprise attack of fascist Germany upon the USSR prevented this. The war began while our air force rear services were still undergoing reorganization. It had to be completed in the course of combat activities in a complex frontal situation. By 1 September 1941 351 air base maintenance battalions were formed in the air forces of the fronts and districts.

Following the organization measures, the aviation base area essentially transformed into a mobile rear services formation, and the formation of air armies in 1942 made it possible to significantly improve its work. The central directorates of the air force, including the rear services directorate, underwent partial reorganization at that time as well. The correctness of the air force rear services structure adopted in that period was confirmed by the large volume of tasks that had to be completed in relation to material and airfield technical support to the combat activities of aviation. Thus during the war

the personnel of the air force rear services supported about 4 million sorties.

However, the experience of the first months of war, and especially of the winter offensive waged by troops of the Kalinin and Western fronts, showed that because they were inadequately trained, air force rear services were sometimes insufficiently competent and prompt in supporting the maneuvers of aviation. The losses of men and equipment suffered by rear services often precluded the possibility of allocating any sort of reserve to support redeployments of air regiments. Under these conditions allocation of commandant's staffs from air base maintenance battalions, which moved forward together with the advancing frontal troops, became the most acceptable.

We can cite as an example the actions of rear services in support of the maneuver of the 16th Air Army from Stalingrad to the vicinity of Kursk. During the 1943 summer offensive of troops of the Central Front, air base maintenance battalions moved seven to nine times each in support of redeploying formations of the 16th Air Army.

The air force rear services built, restored and reconstructed more than 8,500 airfields in the Great Patriotic War. Simultaneously with preparing the landing strips, they erected about 40,000 aircraft shelters, more than 7,000 command posts and about 3,000 POL dumps and other facilities. It was no accident that the State Defense Committee examined the problems of airfield construction several times in 1941-1942. In this period, which was difficult for the air force rear services, local party and soviet organs provided active assistance, mobilizing the population and allocating transportation to prepare the airfields.

Accelerated preparation of airfields during the war, construction of artificial landing strips and use of prepared highway sections are examples of integrated solution of the problem of providing airfield engineer support to the combat activities of aviation. V. I. Lenin's thoughts on the role of rear services in modern warfare were confirmed once again: "We are winning and will continue to win because we have a rear and the rear is strong...."

The history of the Great Patriotic War is rich with numerous examples of a creative attitude on the part of executives and all personnel of the air force rear services. The Soviet Army air force rear services chiefs generals N. Sokolov-Sokolenok, L. Rudenko and F. Zharov proved themselves to be talented organizers in these years. They were given the important mission of creating, strengthening and improving a new system of rear services for the air force. In the difficult war years the air army deputy commanders for rear services--generals P. Voronov, P. Kazakov, P. Stupin, V. Uspenskiy and others--competently led their subordinates.

The Communist Party and Soviet government gave a high evaluation to the selfless labor of air force rear service personnel. The Order of the Red Star was awarded to eight aviation based areas, 64 air base maintenance battalions and other units.

In the postwar period two interrelated factors predetermined improvements in aviation rear services. First of all aviation was rearmed with jets, and it became necessary to assimilate new methods of building airfields with artificial landing strips and to outfit rear services with new, complex ground support resources. Second, the entire system and structure of control organs, units and services had to be brought into correspondence with peacetime missions, and many of the basic premises concerning rear support to aviation had to be reexamined in light of modern requirements.

Fundamentally new missions were imposed upon air force rear services, associated with servicing new aviation complexes, preparing bases for them, and organizing the storage, preparation and transportation of rocket armament and ammunition, aviation and rocket fuel, oils, lubricants and special fluids. Owing to the concern of the CPSU Central Committee and the Soviet government the flight crews were supplied with special clothing, pressure suits and navigation gear, and high-calorie nutrition became typical of all categories of personnel.

Improved oxygen, nitrogen and hydrogen production units, electric starting machines and units for aircraft engines, and gas, fuel and other special liquid dispensing units mounted on cross-country motor vehicle chassis began entering the air force rear units.

It became possible to solve this problem owing to development of the country's productive forces and to the achievements of Soviet science and technology. Aviation rear services are now outfitted with multipurpose machines capable of performing several complex operations. They are mounted on ZIL-131 and GAZ-66 motor vehicle chassis. Thus modern electric-hydraulic units can electrically start an aircraft engine, test electronic systems and onboard electric circuits, and fill and test the hydraulic systems of airplanes.

The transportation possibilities of the air force rear services have broadened significantly as well. High-capacity truck trains coupled with highly productive mechanized freight handling resources have significantly reduced the proportion of manual labor and created the conditions for prompt delivery of various cargoes to the airfield.

Air bases have transformed beyond recognition. Well outfitted school and residential buildings, personal service combines and athletic facilities are providing services to pilots, navigators, engineers, technicians and other specialists. Officers' clubs, clubs, dining halls and stores are now an inseparable part of every garrison. Much attention is devoted to esthetics. The latest models of various household appliances and modern comfortable furniture are being introduced. As in former times, the efforts of air force rear service specialists are directed today at providing everything airmen need for normal service and combat training, for interesting leisure time and athletics. This same noble goal is served by competitive reviews that have recently been held under the slogan "Model personal services for every garrison."

Special attention is now being devoted to remote areas with unfavorable climatic conditions in accordance with decrees of the CPSU Central Committee and the Soviet government. "Personal services--the concern of all!"--this motto has become the driving force of not only air force rear service personnel but also all officers and commanders. One of the tasks is to learn to make effective, high quality, efficient use of local possibilities. "Concrete concern for a concrete individual and for his needs and requirements is the starting and end point of the party's economic policy..." said CPSU Central Committee general secretary, chairman of the Presidium of the USSR Supreme Soviet, Comrade L. I. Brezhnev at the 26th CPSU Congress.

A persistent effort is being made to economize on fuel, power and other material resources. Aviation is known to be the most intensive consumer of various fuels and lubricants. Operating expensive airfield technical maintenance resources and storing large quantities of material at their dumps, air force rear service soldiers are aware of their high responsibility for economization of these resources and their careful maintenance. A movement for the right to be called a collective of the thrifty has taken shape among the subunits.

Personnel of the air force rear services unanimously approve of the decisions of the May (1982) CPSU Central Committee Plenum and the proposals and conclusions spelled out in the report by Comrade L. I. Brezhnev "On the USSR Food Program in the Period to 1990 and the Measures of Its Implementation", and they avidly support the modern agrarian policy of our Leninist party.

One of the most important directions in the activities of the air force rear services is teaching the commanders and their deputies for rear services the best methods of flight support and troop management. High military and technical training in rear services functions is extremely important to officers responsible for organizing rear support. The demand for engineering and technical personnel has grown immeasurably in connection with the transformations that have occurred in the material-technical base of the air force rear services. After all, the two sides of the activities of rear service and subunit executives--the functions of command and the engineering and technical functions--are growing closer and closer together. This is why military schools that train specialists for the rear services are constantly improving the training system and introducing advance formed and methods of training. The training laboratory base is being continually renovated and improved in higher military schools and academies, and educational work with students and cadets is growing more intense.

Exercise "Zapad-81" was a serious examination of the preparedness and capability of air force rear services to complete their complex and responsible missions in the course of a swiftly changing situation. During the exercise the personnel of the air force rear services demonstrated high special skills, proficient handling of the equipment and the ability to support air units and subunits with limited men and temporary airfields.

The experience of the exercise and of the combat training of rear services shows that it is very important to utilize all possibilities for raising the



mobility of rear services today. We must constantly improve the equipment of the rear services, improve their training material base, and devote more attention to studying the rules of operating the equipment, machine units and mechanisms. We must strive for faultless efficiency, firm, conscious military discipline and strict and precise fulfillment of the requirements of the military oath and the regulations.

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## AIR FORCES

### FIGHTERS: READERS' COMMENTS ON TACTICAL VALUE OF PAIR VS. SINGLE AIRCRAFT

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 82 (signed to press 2 Jul 82) pp 26-27

[Text] Discussion of the article "A Pair or One?" by Colonel V. Belyayev (AVIATSIYA I KOSMONAVTIKA, No 11, 1981) produced many responses from the readers of our journal. Several of them sent to the editor's office by students of the Red Banner Order of Kutuzov Military Aviation Academy imeni Yu. A. Gagarin are published below.

One on the Battlefield Does Not Make a Soldier, by Maj L. Nikitovskiy, Military Pilot 1st Class

Thinking about the question "A Pair or One?", I involuntarily recalled some episodes from the memoir literature and from the combat training of the regiment in which I served.

I would have to agree with the author that the firepower of modern fighters is much greater. But it is not always possible to utilize it fully when operating on one's own. For example when flying in mountainous regions, use of the airplane's radar sight does not always produce the desired result owing to interference from mountains and clouds. This means that the target must be sought visually, and information must be asked for from the ground.

As a rule the followers are first to detect a target. An experienced pilot can suggest the attack maneuver to the leader, and following the attack the leader can occupy an advantageous position to help the followers regain contact with the target if it had been lost for one reason or another. Well coordinated pilots can always provide enough attention, and they can avoid excessive radio communication. They always know what to do.

Here is another factor of no small importance--the feeling of having a comrade nearby. I recall one sortie that I had to fly on my own (I was a lieutenant at the time). The oppressive silence and the sense of loneliness in the air "shred" the nerves and reduce confidence. I also recall a long-distance flight I made with an experienced squadron commander. The sensations were entirely different in that case. I flew as the follower, but I was able to

use the terrain to get my bearings, mentally figure the remaining fuel and tune into the homing radio stations to check on my course. Thus there is reason behind the folk saying that one on the battlefield does not make a soldier. And this is that much truer in the sky. I vote for the pair!

Only a Pair, by Maj M. Bobrov, Military Pilot 1st Class

The question "A Pair or One?" being discussed on the pages of this journal appears extremely important to me. But my answer to it would be categorical: A pair, and only a pair. It is the fire and tactical unit of today.

But the pair must also satisfy certain requirements. In order to minimize the shortcomings of a pair pointed out in the article by Colonel V. Belyayev, the same people must undergo flight training together. For example pilots who had flown together for 2 or 3 years and who had undergone training together in maneuverable aerial combat can successfully conduct combat activities in any conditions. This is the main thing for fighter pilots. Moreover we cannot forget the morale factor: After all, it is easier when you feel the presence of a comrade nearby.

Aid to a Comrade Will Be Needed..., by Lt Col V. Kryuchkin, Military Pilot 1st Class

A pair or one? In my opinion the only answer in fighter aviation is--a pair. This would be true even despite the fact that firepower of airplanes has risen and that new sighting and navigation complexes, piloting resources and other instruments have appeared.

The author of the article "A Pair or One?", Colonel V. Belyayev, examined this problem in relation to aerial combat using long-range missiles. But if the first strike, made from long range, fails for some reason or another, the combat may become fluid, and infantry and artillery armament would have to be used. In such a case the attacking pilot would be compelled to maneuver, and consequently he would require the assistance and support of a comrade. Irrespective of whether he is the leader or follower.

Under modern conditions, considering the development of electronic warfare resources, the use of onboard radar sets is becoming more difficult. This is why visual search continues to play an important role. And the possibilities of a pair are much greater in this case than those of a single airplane: The probability of timely detection of a missile launch from the ground and of a timely antimissile maneuver increases.

Moreover despite arrival of new piloting resources the significance of visual orientation has not decreased, and we may even say that it has risen. We should keep in mind that during combat activity some ground resources will be annihilated and some will be turned off for the purposes of concealment. And under such conditions orientation would be much more dependable by a pair of airplanes, especially if the combat formation is properly organized.

And Here Is What I Think..., by Lt Col I. Yankovskiy, Military Pilot 1st Class

According to the laws of dialectics, everything is in motion and constant development. We can see this especially clearly in the development of military aviation and its tactics. But the new has never completely negated the old. And so we would have to approach the question "A Pair or One?" from this point of view.

In my opinion we cannot completely reject the pair and defend the lone airplane. The article by Colonel V. Belyayev presented arguments in favor of the pair and the lone airplane, and it showed their shortcomings. But these arguments only confirmed that the pair has not outlived its time. First of all one can fly in combat with greater confidence if a comrade in arms is along. It is always harder for one. Second, the possibilities of a pair are significantly higher, since the probability of engaging a pair of enemy airplanes in combat is extremely high. But even a lone enemy airplane is a powerful opponent, and it would not be easy to deal with him.

Today, aircraft cannot always fight as a pair--that is, in loose combat formations. I think that the possibilities of the modern airplane would reveal themselves more fully if aerial combat were conducted by two unpaired aircraft--that is, aircraft not bound to a particular place in formation. After all, airplanes can provide cover and support to one another just as long as they maintain visual contact, interacting with one another tactically. In this case both the maneuvering characteristics of the airplane and its armament would be utilized more effectively. Therefore flying should be done in pairs, while aerial combat should be conducted by lone airplanes. This also makes it possible for the leader and the follower to exercise broader initiative.

It Is More Reliable With Two, by Maj A. Belkin, Military Pilot 1st Class

The question raised in the article is very important and interesting to a fighter pilot. I would have to agree that the modern fighter does have the potential for doing much more harm to the enemy than the airplanes of previous generations. Yes, a target can in fact be detected at a range significantly exceeding that of visual detection.

However, fighter aviation performs its main missions in aerial combat. Under modern conditions before engaging in combat activities we would always have to surmount enemy air defenses. This can be done much more effectively in a pair or as part of a group than as a lone airplane. For example a pair employing various maneuvers can evade an automatic targeting or surface-to-air missile guidance station more easily. Moreover, as a rule combat activities would proceed to the accompaniment of the enemy's electronic countermeasures. And this means that it would be very difficult to launch missiles from great range in the presence of intense jamming. Here again, fluid aerial combat would resume its rightful place as the means for defeating the enemy.

I do not agree completely with the author that the leader can restrain the maneuvers of the follower. Before, when airplanes carried only artillery armament, a close combat formation was necessary as a means for maintaining

fire contact. Now airplanes carry guided missiles, and the close combat formation is irrelevant. We must use combat formations which do not hinder the maneuver of both pilots, and which at the same time permit maintenance of visual and fire contact. During fluid combat, maneuvers entailing separation and temporary loss of visual contact would be fully permissible. Utilizing unstereotypic maneuvers in which the formation breaks up (in a case where we are the attacking side), we can mislead the enemy. Attacking one airplane (the leader or the follower), the enemy sets himself up for the fire of the other crew. Understandably, in this case the pair is the fire and tactical unit.

When the combat mission entails annihilating ground targets, the pair has the possibility for attacking from different directions, maintaining a minimum time interval between the attack. For example on leaving its final reference point the pair can break apart without losing visual contact. The leader can attack the ground target using one maneuver, and the follower can use another. The latter also has the possibility for observing the results of the leader's strikes.

We can present many examples and much evidence showing that a mission requires a pair, and not a combat unit. In rare cases, it seems to me, the lone airplane can successfully execute a mission.

I think that we cannot entirely reject the idea that "the follower is the shield of the leader." It has been modified. Evidence of this can be found in the dialectics of the development of the forms and methods of the combat activities of fighter aviation.

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## AIR FORCES

### FIGHTERS: DISCUSSION ON TACTICAL VALUE OF PAIRED VS. SINGLE AIRCRAFT CONTINUES

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 82 (signed to press 2 Jul 82) pp 26-27

[Article by Lt Col (Res) V. Dokuchayev: "In the Sky, One Alone Can Be a Soldier"]

[Text] Tactics is an area of the art of war which reacts sensitively to changes in military technology and armament. In his article "A Pair or One?" Colonel V. Belyayev posed a very important question, the answer to which can influence the combat potentials of fighter aviation.

I do not agree with the author's assertion that most fighter pilots believe the pair to be the principal fire and tactical unit. If this is in fact so, then it appears to me that it is only because they are reluctant to correctly evaluate the realities, and because they maintain a superficial approach to the great experience of the Great Patriotic War. Another reason may be that because of the diversity and complexity of missions executed by flight crews in daily combat training, some theoretical problems are left unattended. What makes that obvious is the fact that it has taken so long to address the question as to what the fire and tactical unit is. There can be no doubt that in the end, it will be answered at the highest level.

While the pair is officially presumed to be the fire and tactical unit, life and flying experience elevate the lone airplane to this position. Take as an example two military collectives. In one, all of the pilots are trained for combat activities as pairs, engaging in daytime flying in simple weather and above the clouds. Without a doubt such a collective can execute a limited range of missions. And on the other hand, a collective in which the personnel are prepared to operate day and night in all weather conditions as individuals is capable of handling any assignment. Thus the pair is not the foundation, but a supplement.

A pair of propeller-driven aircraft and, later on, of cannon-equipped jet fighters not carrying radar sets could conduct combat activities when the target was visible. Given the relatively low effectiveness of the armament, the firepower of the pair was significantly higher. Moreover the low range of fire made it possible for pilots in a pair to cover one another dependably.

But the missile-carrying all-weather fighter has changed this situation. And the more the armament system was improved, the more noticeable these changes became.

The modern lone fighter can successfully conduct combat activities day and night in any weather conditions within a broad range of speeds and altitudes. Moreover it can effectively annihilate the enemy at ranges significantly exceeding the range of visual detection. Moreover the possibilities of the missile armament are so great that the lone fighter is capable of striking any target, and not just one. Thus the effective range of missiles precludes mutual security of pilots in a pair.

But what is a pair? As before, it can be used in combat against a visible target. But Colonel D. Goldyrev's response (AVIATSIYA I KOSMONAVTIKA, No 4, 1982) creates the impression that he wishes to dispute the previously defined tactic. It could not be that he is seriously confusing the basic fire and tactical unit with the list of strengths of fighters. I am referring to the ability to maintain prescribed parameters within a combat formation with the assistance of onboard radar. This method was used by fighters of the second generation. Call it what you will, but the essence of the method does not change. In it, the onboard sight made it possible to maintain not prescribed parameters but only those which the set permitted. The important thing here is not the pair but two lone fighters. Such flights were performed by pilots who had not worked themselves into a unit and who were generally not certified for flying in paired combat formations. Everything was as it should be: The leader could not support the follower with fire, nor could the follower support the leader, even though he observed him with a sight.

Moreover it is extremely difficult for a leader to maintain control in such a combat formation--were we justified in referring to it as one--because of the limited information available about the aerial situation. In essence, what we have is not a leader and a follower but a pilot flying in front and responding to the commands of a guidance station, and a pilot flying in the rear, responding to the same commands and orienting himself by the pilot flying in front. Such flight would be permissible only when the potentials of the guidance resources are extremely low.

Moreover this violates one of the fundamental principles of using fighter aviation--surprise. When the onboard radar system is turned on following take-off, the fighter reveals its presence, and an attack by a succession of two airplanes takes too much time. But a strike from different directions simultaneously at different angles of attack by two lone fighters individually controlled from the ground may be incomparably more effective. In this case the modern equipment is utilized to the fullest as well, and surprise is attained. Moreover the enemy is limited in his possibilities for maneuver in such a way as to foil the attack.

Moreover fighters being guided by the ground may fly in a formation which would permit one to repel an attack at his partner at the needed moment, once again in response to commands from the command post. And the feeling of someone nearby would be tremendously more tangible in this case than in a

pair, in which the pilots would be unable to help one another. In addition to weather conditions and time of day, the range of speeds and altitudes also limits the possibilities of using a pair. Moreover the closer we come to the limiting values, the greater the limitations are.

And so the following conclusion begs itself: As sighting resources and weapons have developed, the lone fighter has received a possibility for conducting combat activities anywhere and anytime, while this advantage has not been extended to the pair. Does this mean, then, that the extremely limited unit is still the basic unit?

I am sure from everything we have said so far that it could not be concluded that the pair should be abandoned. The question lies only with what the basic unit is. As before, the pair continues to be a formidable force. But when and how it is to be used--this is a matter of the air commander, who would make a competent decision on the basis of the concrete situation. We should not forget in this case that fighters perform a diversity of missions. Therefore it is no accident that fighters are designed to do different things.

As far as training pilots to work in pairs is concerned, the main thing here is to achieve excellent coordination within the group, without which it would be impossible for a fighter to exist. Pilots who have not worked themselves into a coordinated pair would be unable to engage in fluid aerial combat or use their weapons successfully.

And so, the modern lone fighter is the fire and tactical unit. Were we to assert this premise officially. we could raise the combat effectiveness of fighter aviation, organize interaction more successfully, expend effort and resources more sensibly, including for training purposes, expand the tactical skills of the personnel--especially tactical control officers, and promote further improvement of fighter control resources.

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## AIR FORCES

### FLIGHT SAFETY: DRAG PARACHUTE FAILS TO OPEN

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 82 (signed to press 2 Jul 82) pp 32-33

[Article by Maj Yu. Andronov: "The Accident Was Averted, But..."]

[Text] The airplane was coming in for a landing. Observing the quickly descending craft, the flight leader held the microphone in his hands ready to help the pilot at any instant. But there was no need for this. A top-class air warrior piloted the bomber precisely on its glide path and touched down softly. The leader wanted to congratulate the pilot on his neat landing, but he restrained himself: The flight had not yet ended.

The officer strictly adhered to the rule of keeping an airplane under observation until it taxis off of the landing strip. He kept his eye on the swiftly moving craft. "The drag parachute should have deployed by now," the flight leader thought. Another second went by.

"Parachute," his voice traveled over the airwaves calmly and commandingly..

By this time the pilot had performed all actions required for normal and emergency deployment of the drag parachute. But the familiar jerking sensation never occurred.

"They haven't deployed," the officer reported by radio.

The pilot knew how complex the situation was, and therefore he braked competently and cautiously. The airplane's speed gradually dropped. The bomber came to a halt before reaching the emergency braking wire. Damage to the warplane was averted.

Pilots, technicians and parachute packers awaited the airplane as it taxied slowly to the parking pad. Everyone wanted to know the cause of the failure of the drag parachute release system, which had always worked so well.

"Could it be that the canopy had frozen?" someone suggested.

"No way," the squadron deputy commander for the air engineer service immediately replied. "Before the flying I gave instructions to replace the parachutes in all airplanes."

While saying this his eyes searched for the aircraft technician A. Samoylov, but the latter had already gone forward to meet the approaching bomber and was "guiding" it to its place, observing all precautions. Giving the signal to switch off engines, Samoylov stepped quickly to the parachute compartment, which was located at the back end of the fuselage. This was an anxious moment for the young officer. Looking into the open compartment, he immediately understood what happened: An empty parachute cover hung from the pins.

Earlier, Senior Lieutenant of Technical Service Samoylov had accepted the airplane from the specialists of the technical maintenance unit. A detailed inspection showed that they had completed all of the repairs as required. Then the technician towed the craft to the parking pad. Setting the switches and controls to their ready positions, the technician adjusted the scale of the fuel gage to indicate maximum fuel, and he poured fuel into the tank. Then he told mechanic Private V. Mekhanoshin: "I'm going to a meeting. Call the parachute packers, check the container and install the parachutes."

"Yes sir," the soldier replied.

There is a significant detail that should be noted in this conversation between the technician and his subordinate: The officer did not make sure that the soldier had correctly understood his task. And there was reason why he should have done so: The mechanic had performed a rather large number of jobs within a short time that day, and he was tired. Moreover at the moment the senior lieutenant was talking about the parachutes the soldier was still doing another job.

The aircraft technician apparently failed to account for all of this. Nor did he remember what the Internal Service Regulations say about this: "When it is necessary to make sure that a subordinate understands instructions correctly, he should be required to briefly repeat the instructions given to him." It was not until later on, during the critique of the near-accident, that it was established that Private Mekhanoshin did not understand Samoylov's instructions. After the officer left the soldier completed his job with the other mechanics, and he simply did not have enough time to check the container and install a parachute. All he did was replace the ground safety cord--a flexible cable with a gaudy red flag.

But unfortunately the violations did not end with this. The regulations require a serviceman to report fulfillment of instructions to his chief. But the mechanic did not do so. And Senior Lieutenant of Technical Service Samoylov did not ask the soldier to report on the work done. This subtle detail in the mutual relationships between senior and junior is not unimportant: It indicates that the crew had gotten used to "insignificant" deviations from the regulations.

It took a great deal of time before the craft was accepted. The technician checked the units and mechanisms, and he filled out the documents. The pre-flight preparations of the aircraft were checked out. Strange as it may seem, however, Samoylov did not look into the parachute compartment. This is something he should have done mandatorily.

As was required, prior to towing the airplane to the technical maintenance unit the parachute canopies had been dropped off, but their covers were still in the compartment. The technician never checked for the presence and the condition of the parachutes. Thus what resulted was a "planned" near-accident. The chief of the technical maintenance unit and the squadron deputy commander for air engineer service could also be accused as accessories to the near-accident, quite validly: They had not determined whether or not Samoylov had done his work.

The last element in preparing drag parachutes for use is removal of the ground safety. According to the instructions the pilot accepting the airplane should have made sure that the lock on the doors was shut, and he should have asked the technician to remove the safety from the parachute pack (pull out a cable) in his presence. But the safety had already been removed before the pilot's arrival. Because the compartment was closed, the pilot was essentially deprived of the possibility for checking the parachutes.

"Did you check the parachutes?" the engineer asked the pilot that day.

The response was ambiguous.

One day, one of the bombers took off with a safety still on due to careless inspection. After this, an effort should have been made to conduct extensive explanatory work aimed at raising the sense of responsibility of the engineers and technicians for aircraft preparation. But publication of an order requiring removal of the ground safety immediately after installation of the parachutes was all that was done. The probability that an aircraft would take off with the parachute safety still on was decreased. But this was achieved by violating the instructions and weakening the effectiveness of the control over the quality with which the aircraft were prepared for take-off.

Sometimes it happens that in violation of the established rules, the mandatory requirements of documents are amended locally by oral instructions and recommendations. Occasionally such changes do produce a certain positive result, but later on, this invariably leads to problems. So it was in our case as well.

Before we can arrive at an objective conclusion from our analysis of this near-accident, we should say a few words about the person directly to blame for the incident--Senior Lieutenant of Technical Service A. Samoylov. He had served more than 3 years in the unit prior to the incident. His performance report states: "Serves as an example in questions of military discipline and diligence. He has made an excellent study of the airplane's design, and he performs all practical jobs competently." The young officer did in fact prove himself to be a good technician, and the Komsomol members of the squadron elected the officer to the bureau. This means that his carelessness was not negligent. What, then, brought it on? The fact is that Officer Samoylov had been on leave, and immediately upon his return he was given an airplane of his own in the technical maintenance unit. While on leave, specialists lose some of their habits of servicing of the equipment, and their professionalism suffers. I bring this up because I am far from the opinion that Samoylov

brought the near-accident about owing to indifference. The unfavorable consequence of a long interruption in work was the more-likely culprit. Obviously the officer should have been given some time to get back in form, as athletes say.

There is a rule in aviation that following a lengthy interruption in flying, a pilot must be given a possibility for restoring lost habits in piloting and combat use of an airplane. Should not this rule be extended to technicians as well?

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## AIR FORCES

### TECHNICAL SCHOOLS: ELECTRONICS TRAINING

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 82 (signed to press 2 Jul 82) pp 34-36

[Article by Engr-Lt Col I. Strizhanenko: "Effectiveness of the Training Hour"]

[Text] The young officers, looking neat and a little anxious, froze to attention in smart formation. They were parting with their school and going to a new place of service.

These solemn minutes are remembered for a long time to come not only by the lieutenants but also by us, the commanders, chiefs, teachers and instructors. It is as if one sees the results of one's labor and senses high responsibility for the training and indoctrination of aviation technicians in a new way. Involuntarily, past efforts are mentally evaluated, and the question is asked: What else could be done to raise the effectiveness of the training hour, so that future technicians would successfully master all of the subtleties of operating modern airplanes? And the requirements on specialists are rising from one year to the next.

I take pleasure in noting that for several years in a row already, the school has been receiving good reports from the units on many of our graduates. The young people work themselves in quickly, and they are soon certified for independent operation of the complex weapon systems and for combat duty. But unfortunately there also are young officers who make mistakes and display a lack of discipline. We believe ourselves to be to blame for this. Apparently we have not utilized all possibilities and reserves in the training and indoctrination of future technicians. We subject shortcomings to exacting and principled discussion at party and party committee meetings and in instructor training conferences. Concurrently we thoughtfully study and persistently introduce the best experience of the best instructors.

In this connection I would like to describe the experience of a radiotechnical course given by Engineer-Colonel I. Sutyurin. The course collective has long held onto the outstanding title, and it is confidently leading the socialist competition for an honorable welcome for the USSR's 60th anniversary. The course methods commissions, which are staffed by the best teachers--Engineer-Colonel I. Sutyurin, engineer-lieutenant colonels Ye. Lepeshev and V. Starovoytov and others--are working effectively and purposefully. Their recommendations

are the result of lengthy observations and experiments. Their conclusions and developments help young instructors a great deal in organizing the training process.

Thus before the commanders of training subunits begin studying electronic instruments, radio transmitters and the fundamentals of pulse technology, radar and other difficult subjects with the cadets, they are invited to a meeting of the instructor training commission. They are acquainted with the specifics of the topic, the difficulties usually encountered are explained, and the sort of assistance instructors can provide to failing cadets through supplementary talks and training sessions is described. They work together to determine the optimum time for organizing such lessons. The mutual understanding existing between the instructors and the executive staff has a favorable influence upon the academic success of the cadets. As a rule all instructors had accumulated good experience in aircraft operation in the units, and they now make competent use of their acquired experience in teaching the future air specialists.

Explanation of the orders of the USSR minister of defense and the air force commander in chief associated with raising the combat readiness of the air units and subunits and mastering complex equipment and weapons occupies a noticeable place in the activities of the officers. Displays describing the life and military training of the personnel and the best experience in aircraft operations have been set up in the classrooms and laboratories. Visual aids publicize the high requirements imposed today on specialists of the air force engineer service--on their technical knowledge and their moral and psychological maturity; these visual aids also deeply analyze malfunctions that have arisen in the past at the fault of specialists.

But experienced teachers once noted that not every lecture given by an instructor was deeply impressed into the consciousness of the cadets, and that not every lecture provided the needed impact. Obviously the teachers were not accounting for all of the particular features of their audience. Now, so as not to waste time repeating the same thing, and concurrently to raise the creativity of the students, the best officers are making increasingly more frequent use of problematic situations in their teaching effort.

As with the progressive training method, which does produce a good impact, the problematic training method has recently been the target of a great deal of attention in the teacher training literature. The instructor explains a situation to the students, describes the external manifestations of a physical process, and then provides each cadet the possibility for making the necessary conclusions on the basis of previously acquired knowledge.

It stands to reason that far from all answers are correct and accurate. But well organized discussion leads the cadets to independent, valid conclusions and encourages them to competently defend their point of view. The instructor must be a highly proficient teacher, and he must have the ability to interest the audience, so that a creative discussion would not transform into a pointless conversation. This expertise does not come right away. To acquire it, the teacher must work a great deal, he must read special collections, and he should attend lectures on the subject.

An example of using the problematic training method can be found in Engineer-Lieutenant Colonel L. Medvedev's analysis of the vacuum triode. Rather than setting up the operations in algorithm form, he posed this task to his audience: How can measuring instruments and a completed circuit be used to determine the parameters of a triode? Following a persistent search, the cadets independently came up with the three readings method, known in electronics but unfamiliar to them.

While in former times the problematic method was basically limited to lectures and seminars, it is now being applied to laboratory lessons as well. Our instructor-officers have gone even further. To write the manuals accompanying the laboratory lessons, they used the algorithmic format--precise description of the solution of a given problem in a particular sequence. In some cases the algorithm is the sole means possible. But sometimes cadets can propose their own scheme for testing a particular instrument, or determine another sequence for conducting an experiment, which raises their interest in the lessons even more, and increases the effectiveness of the lessons.

Introduction of progressive training forms necessitated solution of another problem--qualitatively improving and updating the training material base. In former times the equipment available to the course had been adequate to support complex operations, making active use of visual aids, devices and instruments during lectures and group lessons possible, but as the training process grew more complex, the need arose for approaching the methods of their use in a new way.

Much was done in this direction by the course's efficiency experts. Engineer-majors A. Yatsenko, V. Ul'yanov, V. Kovalev and others took charge of cadet inventor groups which studied the equipment and created new laboratories concerned with the fundamentals of automation, computer technology and radio-technical measurements, and they organized a classroom containing trainers for the fundamentals of pulse technology and radar, and a classroom in radio engineering. These classrooms are now outfitted with original equipment helping the cadets acquire the necessary habits within the full volume of the program.

The instruments and working models make perception of physical laws and phenomena easier, and they raise the interest of the cadets in the subjects they are studying. For example now that electronic testing units have been introduced, each day it takes 10-15 minutes for the officers to determine how well the class has assimilated the topic being studied and give an objective score to each student.

A new demonstration and teaching device or a stand is placed into use not right away but after being appropriately tested in action. Take as an example the training receiver manufactured by instructor Engineer-Major A. Matyunin and practical instructor Warrant Officer N. Shmidt of the radio receiver laboratory. Prior to the group lessons all of the classes were briefed on how to tune and inspect the apparatus, except that in some classes the briefing was accompanied by demonstration of the receiver tuning and measuring procedure using the demonstration and teaching display, while in other classrooms this was not done.

The cadets of all classes then began their work. They tuned the intermediate-frequency amplifiers, mated different circuits, determined sensitivity, selectivity and passbands, and so on. The results of each operation were recorded immediately. It was found that given an identical level of theoretical knowledge, the habits of tuning a radio receiver were stronger among cadets who had undergone the training than among fellow classmates who had not. Now this method is used more frequently.

Sometimes in order to demonstrate different characteristics of a particular phenomena being studied, instructors use technical resources in integrated fashion. But as many years of experience have shown, it is unsuitable to use several visual aids discussing the same aspects of an object. We now use only those instruments which are necessary to the study of a concrete subject.

Projection equipment and tape recordings are required in some lessons. Filmstrips have been made under the guidance of the instructors. These filmstrips make it possible to trace the logical sequence of the material; moreover they make lessons more interesting and reduce the tiring of the cadets. An experienced teacher shows a filmstrip in parts. He varies the sequence of the frames, on occasion coming back to some of them.

The instructors of this course are true propagandists of technical culture. They encourage the cadets to participate in efficiency work and invention efforts based on materials of the training program. They make full use of scientific-technical information on inventions and on innovations exhibited at the Exhibition of the Achievements of the USSR National Economy. This produces good results. As a rule the innovative cadets are more highly organized, and they are more successful in their academic efforts.

Technical creativity not only develops the professional interest of the future air specialist but also broadens his outlook. He masters his specialty more quickly, and he swiftly becomes a dependable assistant to air warriors.

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## AIR FORCES

### AERONAUTICAL ENGINEERING: POWDER METALLURGY IN AIRCRAFT CONSTRUCTION

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 82 (signed to press 2 Jul 82) pp 36-37

[Article by Engr-Lt Col Ye. Ivanov, candidate of technical sciences, docent: "Powder Metallurgy in Aircraft Construction"]

[Text] "To support acquisition of articles exhibiting higher resistance to wear, longer life and greater corrosion resistance, and to reduce the labor and metal intensiveness of machines and mechanisms, triple production of powdered metals."

From the Basic Directions of  
the USSR's Economic and Social  
Development in 1981-1985 and  
in the Period to 1990.

The creation of new models of aviation equipment requires materials with high operational and production properties. They are obtained by various methods, including that of powder metallurgy. The procedures for making these materials are rather simple. First a powder is made from metals, alloys and chemical compounds by various means: mechanical pulverization of metal chips in mills, spraying of liquid metal by compressed air or steam, electrolytic precipitation, reduction from metal oxides and so on. Then a stock is prepared out of them: Impurities are removed from the material, and then the latter is dried, sorted with respect to particle size, and mixed. To make a part, the stock is molded at high pressure. But its strength is not very great. In order that mechanical bonds between powder particles could be substituted by stronger interatomic bonds, the part is sintered in a protective atmosphere.

This procedure differs fundamentally from the traditional means of making parts and machine units for airplanes and helicopters. It has a great future ahead of it. First of all it reduces the laboriousness of the process and reduces relative material consumption. The powder metallurgy method also has another advantage over traditional methods of manufacturing aircraft parts. Using it, we can impart properties to machine units which cannot be achieved by other methods. Thus friction brake discs and contacts are made in aircraft construction from an alloy of tungsten and copper. The life of these parts is significantly longer than that of parts made before, and sintered aircraft brake linings can be reused.

Tungsten-copper contacts in machines used to weld aircraft structures together exhibit 20-30 times the wear resistance of pure copper. The economic effectiveness of using articles made by the powder method is very great, expressed in the hundreds of thousands and millions of rubles.

Powder materials are used in modern aviation as antifriction, friction, porous, dense, infusible, electrotechnical and hard alloys. Antifriction materials used in sliding bearings have a porous structure. The pores are filled not with oil, as is the case with conventional sliding bearings, but with graphite, the sulfides of various metals or fluoroplastic. These bearings can be used at 500-700°C. Moreover they can work in a vacuum and under corrosive conditions.

Materials used to seal circular gaps and labyrinth seals in aircraft engines may be classified as antifriction materials to a certain extent. In this case a gap allowing for thermal expansion of vanes is left between the engine body and the edges of the vanes. But too big a gap would reduce the efficiency of the propulsion unit. Use of a sealing layer prevents this problem. As the vanes expand, they cut grooves into the sealing layers, which are made from sintered materials. The best of them are materials based on Nichrome-graphite or Nichrome-boron nitride systems.

Growth in the requirements on the heat capacity of articles used in aircraft friction brakes made it necessary to switch from asbestos-type materials to powder materials. When an airplane lands, more than 400 megawatts of energy must be absorbed within 30-40 seconds of braking time, meaning that the temperature of the braking unit rises and the coefficient of friction drops. Powder materials are capable of maintaining a high coefficient of friction. They experience low wear within a broad range of temperatures. Materials obtained from infusible compounds, particularly titanium carbides and borides, are said to be promising for aircraft brakes.

Porous sintered materials are used to manufacture filters that remove solid particles from liquids and gases and that cool various units of modern aircraft. Filter paper, fiber, special grades of felt, metallic mesh, and fluoroplastic, nylon and other porous materials are used extensively in foreign and Soviet aircraft construction to produce fine-cleaning filters. Water and adhesives may separate from the filter elements during operation under the influence of high pressures and temperatures. Such parts have a short life; moreover they are not heat-resistant, the useable range of temperatures is limited, and it does not exceed 150-200°C. Moreover filter elements consisting of metallic mesh do not clean as well as similar elements made from paper and felt.

Filter elements made from porous materials exhibit high heat resistance (from -250 to +2,000°) and a good cleaning capability. They can trap particles down to 3-5  $\mu$  in size. Moreover porous filters are easy to regenerate, they are not hard to make, and they possess high technological properties: They may be welded, soldered and rolled. Our industry is now producing filter elements out of porous bronze intended for fine-cleaning of AMG-10 fluid. These elements are designed for the series-produced FG-11 filter, which has a productivity of up to 40 liters per minute. Bronze porous filter elements used in aircraft oxygen equipment have special significance. They play an important role,

creating normal conditions for the work of aviation equipment during flight at high altitude.

Pavilions of the Exhibition of the Achievements of the USSR National Economy contain exhibits of parts made from powdered steel that had initially been chrome-plated; porous metal intended for filter elements working in liquid media--water, gasoline, kerosene and oils. Chrome-plating of powders significantly raises the corrosion resistance and strength of filter elements.

Porous filters made from titanium powder have special significance. They do not react with a number of acids at their boiling point, their density is low, and they can trap particles down to  $5 \mu$  in size. Titanium filters are broadly employed in modern medicine to clean intravenous solutions. Use of porous filters made from sintered materials in aircraft construction makes the work of hydraulic systems and fuel apparatus of aircraft engines dependable. Use of porous stainless steel in filters makes it possible to raise the temperature and pressure of the filtered fluid, in comparison with what is possible with paper and Teflon filters. It also permits reduction of the weight and overall dimensions of filters in comparison with bronze filters.

Another use of porous materials is to aid in the cooling of "sweating" elements by dissipating the heat of coolant as it passes through the pores of the material. Of all variants, cooling with gas that is passed through porous metal is the most effective. Air, argon, water, alcohol and other substances are used as coolants for aircraft and engine parts. Porous cooling is also employed when the temperature of the flowing gas is high. For example when the gas temperature is  $3,000^{\circ}\text{C}$ , the temperature of the walls can be decreased to  $800^{\circ}\text{C}$  and lower using several times less coolant than in the case of any other cooling principle.

Powder metallurgy makes it possible to sinter metals together with nonmetals. High-altitude electric brushes made from graphite, copper, lead, silver and cadmium oxide are used in modern aviation equipment. Sintered infusible and heat-resistant materials have special significance. Thus engine nozzles are made from tungsten foam that is subjected to cold molding followed by sintering, after which it is impregnated with silver. This method produces tungsten articles with a density less than  $4 \text{ gm/cm}^3$ --that is, a density almost a fifth of that of compact tungsten. Such articles exhibit rather high impact strength.

In recent years titanium alloy powders have been used successfully to make compressor discs and vanes for gas turbine engines. Silicon nitride is a highly promising compound for the nozzle and operating turbine blades of gas turbine engines. Their high-temperature strength, their heat resistance and their thermal stability are greater than that of nickel-based alloys used today for this purpose.

Powder metallurgy is making it possible to manufacture high-temperature materials not only out of infusible compounds and metals. Aluminum strengthened by aluminum oxide dispersed through it is called SAP (sintered aluminum powder). Its main advantage over pure aluminum is its higher strength and thermal stability. Recently articles made from SAP have been enjoying increasingly

broadener application in aviation technology. Linings and other units of aircraft withstanding temperatures up to 300-500°C are made from them.

Many examples of the use of such materials in aircraft construction may be cited. In particular sintered solid alloys are used for mechanical working of thermally stable alloys. They consist of tungsten, titanium and tantalum carbides filled with cobalt. Alloys based on vanadium, molybdenum and chromium carbides, zirconium and titanium borides and molybdenum (slitsid) are now being introduced.

Diamond-metal materials are being used successfully to grind solid alloys and nitrided and carburized steel, to dress grinding wheels and to work glass. Powdered ceramic material made from aluminum oxide is highly promising at high cutting speeds. It may replace solid alloys in cases where material working proceeds without impacts at a relatively low feed rate. Cutting tools furnished with polycrystalline diamonds such as carbonado and ballas have enjoyed use in the processing of titanium and other solid alloys. The life of cutting tools is six to ten times higher than the life of cutting tools made from solid alloys.

As was foreseen by decisions of the 26th CPSU Congress, further development of powder metallurgy in the 11th Five-Year Plan will be associated with improvement of existing production processes, assimilation of new processes, creation and introduction of new kinds of materials and significant growth in the volume of products manufactured for the national economy, and particularly for aviation.

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## AIR FORCES

### SPACE: TRANSFORMATIONS IN SPACE

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[Article by Doctor of Technical Sciences V. Syromyatnikov, Lenin Prize recipient]

[Text] Powerful rockets regularly leave with spacecraft from the launching pads of space ports. This has already become routine. In good weather the glowing cross of the spacecraft Soyuz can be seen for a rather long time, and about 2 minutes after lift-off this cross can be seen to break apart. This means that it has separated into parts--this is separation of the so-called lateral blocks, or the rocket's first stage. Today, television in outer space provides a possibility for seeing the craft on our screens. Captured by a television camera aboard the Salyut orbiting station, it slowly floats on the background of the earth's blue surface, three or four hundred kilometers away, or on the background of the black emptiness of outer space. When the sun is at the right angle the craft may be seen from a distance of about a kilometer.

Gradually its dimensions on the screen increase. It is turning its side toward the station. The flash of a rocket motor could be seen well. This means that a slight change in the craft's velocity relative to the station had to be made. The last few meters of approach, and the body of the craft takes up the entire screen. Contact. The craft seems to shudder: The approach phase has ended, and docking--the joining of the two structures into a single whole--has begun. A gentle rocking of the craft can be noted, and then it ceases: Rigid connection has been achieved.

The television and movie cameras also provide us pictures of the last minutes of flight, when just the tiny part of the craft that returns from space descends by parachute. The surface of the earth speeds by below, closer and closer. And suddenly the earth churns, like from an explosion. This means that the soft-landing engines have turned on. These are miniature rockets which decelerate the craft just before touch-down.

Between the rocket's lift-off and the craft's touch-down, hundreds of events occur, great and small, and invisible to our eyes. Thousands of different operations are performed. Were we to think about it, and analyze it, we might discover a number of surprising phenomena and transformations. We may reveal,

for example, how a rocket moves, why satellites fly about the earth and do not fall to its surface, where the huge rocket that rose from the space port disappeared to, how the craft was able to find the orbiting station in featureless outer space, how it was able to catch up to and dock with it, why it has to dock at all, and why it returned from outer space to earth so small, in comparison with the rocket that launched it.

The lighter a rocket, the faster it accelerates. Its effectiveness rises as the velocity at which the stream of hot gases flows out increases. This is why rocket designers try to increase the velocity of this stream as much as possible, and to make the structure as light as possible.

The first liquid-propellant rockets came into use in the 1940s. However, they did not satisfy all of the requirements. The struggle to improve them began. Parts that could be done without were abandoned without a second thought. Very light and strong metals and more-effective fuels began to be used. The temperature in the engine chamber was raised as well.

Nevertheless although the rocket was able to fly ever higher and farther, it could not accelerate to escape velocity. This is where it was decided to use K. E. Tsiolkovskiy's idea--using a multistaged rocket.

After the lower and largest rocket uses up all of its fuel it becomes unnecessary; moreover it transforms into excess baggage. This rocket is discarded or, as they say, the first stage of the multistaged rocket separates away. The second stage turns on at this moment, and acceleration continues. But usually the fate that awaits it is the same as that of the first stage. And only the third stage stays together with the craft to achieve the velocity necessary for orbital flight about the earth.

When it returns from outer space to earth, the craft also separates into modules. The descent from orbit is no less complex and dangerous than the rocket's take-off. In order that it could touch down smoothly, its enormous velocity must be quenched, and this needs the same sort of energy that was needed for acceleration--that is, the energy expended by the giant rocket. What the designers are so concerned about is the most important module of the spacecraft--the cosmonaut compartment.

The earth's atmosphere makes it possible to brake a spacecraft due to air friction, which transforms its enormous energy into heat. For example when a Soyuz spacecraft returns to earth it emits enough heat to boil the water in a railroad tank car. During flight, this heat warms up the body of the spacecraft. To protect the inner compartment and the cosmonauts, it is covered with special heat-resistant insulation. The temperature on its surface attains 5,000°C. The insulation used on a spacecraft possesses another property as well: Its surface layer can evaporate, which helps to protect the body from overheating as it is braked by the atmosphere.

It takes only 150 kg of propellant to bring a Soyuz spacecraft to earth. The craft's rocket motor is oriented in braking mode, decreasing the craft's velocity by 180 meters/sec. This amount, small in comparison with orbiting velocity, is enough to cause the craft to descend into or, as they say,

"be captured by" the atmosphere. Braking begins, slow at first, and then increasing, like an avalanche.

The unprotected compartments separate away from the descending craft carrying the cosmonauts, and incinerate in the atmosphere. One might ask the question: Why can't the whole craft be lowered to the earth? For the same reason that rocket stages are separated away: to economize on weight. The additional weight of all of the craft's separated compartments and rocket stages increases as a geometric progression with every additional kilogram that must be returned to earth. As they say, a kilogram returned to earth "weighs" about a hundred kilograms at lift-off.

It is no simple thing to separate rocket stages or spacecraft modules, but it is even more complex to dock a spacecraft with a station. As we know, spacecraft fly at tremendous velocities, though velocities are not even the real problem. The craft must find the orbiting station in boundless outer space, approach it, moving at identical velocity in precisely the same direction and, finally, join rigidly. This is one of the most complex tasks, and it requires the joint work of various systems both aboard the craft and the station, and on earth.

This is not hard for a pilot to understand. The speeds of modern airplanes have grown so much that in order to intercept a target, he needs the help of the earth. Ground radar stations determine the position and direction of flight of airplanes, and then calculate the parameters of the optimum maneuver, which are communicated to the fighter pilot. To catch up to the target, he raises the engine RPM and increases the aircraft's speed. But if the cosmonaut does the same, he would encounter an unexpected effect: The craft would climb to a higher orbit and begin falling behind the station. Thus we find that to catch up with the station, he must decelerate.

This feature is accounted for in the calculations made by the ground flight support services. With their assistance the craft and station approach to within several kilometers, and their velocity relative to one another is reduced to several meters per second. From this moment on we can ignore the peculiarities of celestial mechanics and begin approaching just as airplanes do: catching up in the ordinary way.

But there are still many more difficulties to endure when the craft and station are just about to come in contact. This is the most critical moment of docking. After all, it is very difficult to control a spacecraft that can float freely in any direction and make somersaults every which-way.

How can one not recall the automatic couplers of railroad trains at this moment? More than one generation of engineers and designers agonized over this problem before dependable coupling of rail cars on smooth rails was achieved. In order for cosmonauts to have the possibility to move from one spacecraft to another while in orbit, a tremendously more complex problem had to be solved. A whole system of mechanisms, sensors and instruments provides for gentle cushioning of these many-ton "rail cars" as they collide, for their precise alignment down to fractions of a millimeter, for their rigid

airtight connection, for formation of the transfer tunnel and even for connection of electric lines and hydraulic piping. All of this proceeds automatically in the course of several minutes. All we see is lamps blinking on a console, confirming the correctness of the operation of all elements and fulfillment of all operations.

Suddenly the covers on both sides of the transfer tunnel rattle and fly open. Welcome to my home in space!

Only in outer space, beyond the limits of earth atmosphere, can we come to understand the secrets of nonblinking stars and other celestial bodies and planets. Only from an altitude of several hundred kilometers can we see and study enormous areas of the surface of the earth and the ocean. Only in weightlessness can we grow uniform crystals and perform other technical experiments. In space, man comes to understand himself more deeply. And if Earthlings will in fact have to settle the Universe some day, as K. E. Tsiolkovskiy predicted, will the human body, which was born in earth's gravity, make peace with the weightlessness of space? Or will we have to create space-carousels which would cause something resembling earth's gravity? Thousands of questions, great and small.... They will have to be answered by many generations of cosmonauts to come.

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